

**REMARKS/ARGUMENTS**

Reconsideration of this application is respectfully requested. To this end, petition is hereby made for a two-month extension of time to respond to the outstanding Office Action of October 29, 2009. The fee for the requested two month extension is being submitted with this Amendment. The Commissioner is hereby authorized to charge any deficiency, or credit any overpayment, in the fee(s) filed, or asserted to be filed, or which should have been filed herewith (or with any paper hereafter filed in this application by this firm) to our Account No. 14-1140.

Claims 1-34 are pending in the application. In the outstanding Office Action, the Examiner withdrew claims 12 and 18-34 from further consideration as being directed to non-elected group and species, the Examiner contending that there is no allowable generic or linking claim in this application.

Upon entry of this Amendment, claim 1 will be amended to clarify the claimed invention, claims 2-5 will be amended to better conform such claims to U.S. claim practice, claims 6-17 will be cancelled and new claims 35-51 will be added.

In the outstanding Office Action, the Examiner objected to the drawings as not showing every feature of the invention specified in the claims, contending that the work piece being directly electrically connected to the magnetron sputter cathode must be shown without adding any new matter to the application or the feature cancelled from the claims. Originally filed claim 7 recited that "the work piece is directly electrically connected to the magnetron sputtering cathode, at least during a first period of each driving pulse creating the pulses between the anode and the magnetron sputtering cathode." Because claim 7 has now been cancelled, along with claims 6 and 8-17, it is believed that the Examiner's objection to the drawings is now moot and should, therefore, be withdrawn.

The Examiner has also rejected claims 9 and 10 under 35 U.S.C. §112, second paragraph, as being indefinite. With regard to claim 9, the Examiner contended that Claim 9 recites the limitation "the resistor", for which limitation there is insufficient antecedent basis in the claim. With regard to claim 10, the Examiner contended that the term "short connected" in claim 10 is used by the claim to mean "a break in the electrical connection", while the accepted meaning is possibly "shortcircuited" or "disconnected". Thus, the Examiner contends that the term is indefinite because the specification does not clearly redefine the term. Claims 9 and 10 have now been cancelled, along with claims 6-8 and 11-17. As such, it is believed that the §112 rejection of claims 9 and 10 is now moot and should, therefore, be withdrawn.

Finally, the Examiner also rejected claims 1-11 and 13-17 under 35 U.S.C. §102(e) as being anticipated by Saigal *et al.* (U.S. Publication No. 2004/0112735). The Examiner's rejection is respectfully traversed.

**A. Claim Amendments and Support for Same**

In amended claim 1, the wording of the first line has been amended by deleting the "work piece", appearing twice in the original wording. The original wording "solid-gas plasma" has been replaced by "metal-gas plasma", and the "blobs of the gas" by "plasma blobs of ionized gas". Support for these claim amendments may be found (all references to the original application referring to the published document US 2006/0278518) at least in paragraph [0074] of the original specification.

Further, regarding the pulsed discharges between the anode and magnetron sputtering cathode, it has been added that these discharges are produced - - with a duty cycle of  $1 \times 10^{-7}\%$  to  $10\%$  - -. Support for this amendment can be found at least in paragraph [0030] of the original application. It should be noted that while this paragraph describes previous inventions of the

present inventor, the preferred embodiment of the invention described in paragraph [0086] explicitly refers back to this method. Thus, Applicant believes that it should be found admissible to introduce the limitation on the duty cycle defined in paragraph [0030] into claim 1.

Still further, the phrase "the biasing pulses are produced by both the pulsed discharges and the work piece potential" has been deleted. Applicant notes that the original application, *e.g.*, in paragraph [0111], describes as an alternative, two independent pulsers creating the discharges, so that the biasing pulses are not produced by the pulsed discharges at the magnetron, but separately from those in a second pulser.

Support for new dependent claims 35-41 and 43-49 may be found at least in the following places of the original application (reference again to US 2006/0278518):

New claim 35 (also claim 44) referring to first and second high current pulsed supplies providing the pulsed discharges and the biasing pulses, respectively, is originally disclosed, *e.g.*, in paragraph [0111] ("two independent pulsers") and paragraph [0114] of the application as filed.

New claim 36 (also claim 45) referring to a connection between the magnetron sputtering cathode and the work piece to the negative pole of different high current pulse supplies is originally disclosed in paragraph [0045].

New claim 37 (also claim 46) referring to a frequency of the biasing pulses is originally disclosed in table 1 (page 11) of the original application as 20 to  $2 \cdot 10^4$  Hz.

New claims 38 (also claim 48) and 39 (also claim 47) referring to the biasing pulses being supplied by a DC power supply and a capacitor are originally disclosed in paragraph [0131] and shown in Fig. 3.

New claim 40 (also claim 49) referring to the biasing current being at least 10% of the current of the magnetron discharge is originally disclosed in paragraph [0048].

New claim 41 (also claim 50) referring to synchronization between biasing pulses and pulsed discharges ("processing pulses") is disclosed in paragraph [0060] of the original specification.

New independent claim 43 corresponds to a modified version of present claim 1, *i.e.*, original claim 1 with the present modifications (deletion of "work piece", addition of duty cycle, addition of "plasma" and "metal", deletion of simultaneous production of biasing pulses). Further, in the claim the spreading of plasma blobs has been deleted from the claim.

**B. The Claimed Invention is Not Anticipated by Saigal**

As noted above, the Examiner rejected claims 1-11 and 13-17 under 35 U.S.C. §102(e) as being anticipated by Saigal. The Examiner's rejection is respectfully traversed.

For a claimed invention to be anticipated by a cited reference, the cited reference must disclose all of the limitations of the claimed invention. Here, the subject matter of amended independent claim 1 and new independent claim 42 are not anticipated by Saigal for the reasons discussed below. As such, the dependent claims, which depend from these independent claims are also not anticipated by Saigal.

First, Applicant contends that the term "blob" as used in claims 1 and 2 was not correctly understood in the outstanding Office Action. The wording "blobs of the gas and partially ionized solid plasma", now amended to "plasma blobs of ionized gas and partially ionized metal plasma" refers to a plasma that forms as a result of the pulsed discharges between the anode and magnetron sputtering cathode. Contrary to the assumption in the outstanding Office Action that the blobs correspond to deposited material, Applicant emphasizes that the blobs consist of plasma, *i.e.*, are clouds of ionized particles.

(i) Duty cycle

Both independent claims contain the limitation to a duty cycle of  $1 \cdot 10^{-7}\%$  to 10%, *i.e.*, unusually low values for the duty cycle of a pulsed discharge. Applicant notes that Saigal, by comparison, specifically limits the duty cycle to "1/2 to 1/8" in paragraph [0044].

Applicant also notes that the sputtering method proposed in Saigal is self-ionized plasma (SIP) sputtering, as generally introduced in paragraph [0017] of Saigal, and more specifically explained in paragraph [0040]. Applicant further notes that the original specification of the current application discusses this method already in paragraph [0014] of the original specification and also explains the difference between the SIP method, where a high average target power is reached, and the alternative method according to Kouznetsov US 6,296,742 using high power pulsed discharges, where, as explained in paragraph [0030] of the present specification, it is stated that "because of a low duty cycle of the discharge pulses in the sequence,  $1 \cdot 10^{-7}\%$  to 10%, the pulsed power of each discharge can be very high, whereas the average power is low."

Therefore, Applicant contends that the claimed invention of the present application is not anticipated by Saigal. Applicant further contends that it also would not have been obvious for a person of ordinary skill in the art to apply the teaching of Saigal, related to SIP sputtering, to the claimed invention of the present application using much lower duty cycles.

(ii) Same frequency

Applicant notes that the method according to the present invention works with two different types of pulsed discharges, that is, on one hand, the pulsed discharges between the anode and cathode which create a metal-gas plasma (in paragraph [0060] of the present specification also referred to as "processing pulses"), and on the other hand, biasing pulses,

which are applied between the second electrodes (anode and work piece). According to the invention, as defined in present claims 1 and 43 of the present application, these two types of pulsed discharges have the same frequency.

Applicant contends that, by contrast, in Saigal, there is no relation between the frequency of the electrical power supplied, on one hand, to the magnetron sputtering target 150/146, and on the other hand, to the substrate or work piece (wafer) 148: As shown in Fig. 6, these are supplied by different electrical sources, namely in the case of the target 146 a pulsed DC source 200, for which paragraph [0043] gives a pulse frequency of 1-100 Hz, more preferably 5-20 Hz, whereas the work piece 148 is supplied, as explained in paragraph [0046], by an RF voltage source 210, operating at frequencies in the megahertz range, as explained in paragraph [0047]. Thus, Applicant contends that the electrical power supplied to the work piece certainly has a frequency different from the frequency of the pulsed discharges.

Applicant further contends that it would not have been obvious from the teachings of Saigal to provide for both discharges the same frequency. Applicant notes that the present invention, for the first time, discusses a relation between these two discharges. By contrast, Applicant contends that, in Saigal, the power applied to the wafer 148 is only generally applied "to attract deposition material ions during SIP sputter deposition" (paragraph [0046]); however, no relation to the discharges creating the plasma is discussed.

### **C. Dependent claims**

#### Claim 2

Applicant notes that, as explained in the present specification, and also recited in present claim 1, the plasma blobs move within the processing chamber. Thus, Applicant contends that claim 2 refers to this movement of the plasma blobs, and not to deposited material building up on

the anode, and that, in fact, Saigal contains no teaching to spreading of plasma blobs within the processing chamber.

Claims 38, 48

Applicant also notes that, according to new claims 38 and 47, the biasing power supply, *i.e.*, the power supply supplying pulsed power to the work piece, includes a DC power supply, which is not the case in Saigal, where the power supplied to the work piece (wafer 148 in the disclosed embodiment of the invention) is RF power.

Claims 39, 49

Applicant further notes that, in new claims 39 and 49 the biasing pulses are produced from the charge of a capacitor. This is not disclosed in Saigal, where an alternating voltage (RF power) is supplied to the work piece. Moreover, it would not have been obvious for a person of ordinary skill in the art to supply power from a capacitor given that Saigal teaches to apply an alternating voltage to the work piece. Clearly a alternating voltage cannot be supplied from a capacitor.

Claims 40, 49

Applicant further notes that, in claims 40, 49, the magnitude of the currents of the two types of discharges is compared, and that such a relation is not taught by Saigal *et al.*

Claims 42, 51

Applicant notes that, according to new claims 42 and 51, the pulsed discharges are produced from energy stored in a capacitor. This is not taught by Saigal. A person of ordinary skill in the art would recognize that the long pulses taught by Saigal (in paragraph [0043] a frequency of 10Hz is mentioned, while paragraph [0044] mentions a duty cycle of  $\frac{1}{2}$  to  $\frac{1}{8}$ ) would not be supplied from a capacitor discharge.

**D. Conclusion**

In view of the foregoing, Applicant believes that all of the claims remaining in the application, *i.e.*, claims 1-5, 18-34 and new claims 35-51 are now in condition for allowance, which action is earnestly solicited. If any issues remain in this application, the Examiner is urged to contact the undersigned at the telephone number listed below.

Respectfully submitted,

**NIXON & VANDERHIE P.C.**

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